

# Diversity and distribution of clavarioid fungi in Estonia

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**Abstract:** This paper attempts to compile available data on Estonian clavarioid fungi (Basidiomycota) published between 1856 and 2006 (78 publications) and 986 herbarium specimens studied and observations. 103 species have been reported including 46 species new for Estonia. The most frequent species is *Typhula erythropus*, followed by *Macrotyphula juncea*, *Typhula setipes*, *Clavulina cinerea*, *Clavariadelphus ligula*, *Ramaria gracilis* and *Typhula phacorrhiza*. These constitute around 28% of all observations, but only 6.8% of all species. Twenty one species (20.6%) were collected only once, fifteen species (14.7%) twice and ten species three times (9.8%). Some species rare for whole Europe, but also for its hemiboreal zone, are also infrequently collected, like *Clavaria zollingeri*, *Clavulina amethystina*, *Lentaria subcaulescens*, *Multiclavula mucida*, *Ramaria botrytis*, *Ramariopsis crocea*, *Ramariopsis pulchella* and *Sparassis crispa*. Rare and threatened are the old-growth habitats species like, e.g., *Clavaria amoenoides*, *Clavaria rosea*, *Clavulinopsis rufipes*, *Clavulinopsis umbrinella*, *Multiclavula corynoides*, *Ramaria broomei* and *Typhula sphaeroidea*.

**Kokkuvõte:** Harikulaadsete kandseente mitmekesisus ja levik Eestis

Kirjutises on kokku võetud Eesti harikuliselaadsete kandseente kohta käivad 78 trükises avaldatud andmed (1856–2006), 986 herbaareksemplari uurimise tulemused ja autori vaatlused. Eestist on leitud 103 liiki, neist 46 märgitakse siin esmakordselt. Sagedaim liik on *Typhula erythropus*, järgnevad *Macrotyphula juncea*, *Typhula setipes*, *Clavulina cinerea*, *Clavariadelphus ligula*, *Ramaria gracilis* ja *Typhula phacorrhiza*. Need moodustavad umbes 28% kõigist leidudest, kuid ainult 6,8% liikidest. 21 liiki (20,6%) on leitud ainult üks kord, 15 (14,7%) kaks korda ja 10 liiki (9,8%) kolm korda. Mõned liigid on haruldased kogu Euroopas, nagu *Clavaria zollingeri*, *Clavulina amethystina*, *Lentaria subcaulescens*, *Multiclavula mucida*, *Ramaria botrytis*, *Ramariopsis crocea*, *Ramariopsis pulchella* ja *Sparassis crispa*. Haruldased ja ohustatud on mitmed põlismetsade liigid, näiteks *Clavaria amoenoides*, *Clavaria rosea*, *Clavulinopsis rufipes*, *Clavulinopsis umbrinella*, *Multiclavula corynoides*, *Ramaria broomei* ja *Typhula sphaeroidea*.

## INTRODUCTION

Contemporary knowledge of the diversity of the Estonian clavarioid fungi is based on 150 years of investigations. The first contributions on this group were published by H.A. Dietrich in 1856 and 1859 who mentioned 18 species – *Clavariadelphus ligula* (Schaeff.: Fr.) Donk, *Clavariadelphus pistillaris* (L.: Fr.) Donk, *Clavicornia pyxidata* (Pers.: Fr.) Doty, *Clavulina coralloides* (L.) J. Schröt., *Clavulina rugosa* (Bull.: Fr.) J. Schröt., *Clavulinopsis corniculata* (Pers.: Fr.) Corner, *Macrotyphula fistulosa* var. *fistulosa* (Holmsk.) R.H. Petersen, *Multiclavula delicata* (Fr.) R.H. Petersen, *Multiclavula mucida* (Pers.: Fr.) R.H. Petersen, *Ramaria abietina* (Pers.: Fr.) Quél., *Ramaria apiculata* (Fr.: Fr.) Donk, *Ramaria aurea* (Schaeff.: Fr.) Quél., *Ramaria botrytis* (Pers.: Fr.) Ricken, *Ramaria flaccida* (Fr.) Bourd., *Ramaria flava* (Schaeff.: Fr.) Quél., *Ramaria stricta* (Pers.: Fr.) Quél., *Typhula micans* (Pers.: Fr.) Berthier, *Typhula setipes* (Grev.) Berthier. Parmasto (1963a, 1965) published a check-list of clavarioid fungi including species of the related corti-

cioid genera *Kavinia* and *Clavulicium*. 44 species are mentioned in that papers with data on their geographical distribution and ecology. Clavarioid fungi have been listed in 78 scientific articles on Estonian fungi (see Järva & Parmasto, 1980; Järva et al., 1998; Parmasto & Parmasto, 2005). Only three species – *Clavulinopsis corniculata* (Schaeff.: Fr.) Corner, *Sparassis crispa* (Wulfen: Fr.) Fr. and *Multiclavula vernalis* (Schwein.) R.H. Petersen have been included in the last issue of Red Data Book of Estonia (1999), but seven species into the new edition in 2009 (the three species mentioned above, and *Clavulina amethystina* (Bull.: Fr.) Donk, *Lentaria subcaulescens* (Rebent) Rauschert, *Pterula subulata* Fr. and *Ramaria botrytis* (Pers.: Fr.) Ricken).

The aim of the present study is to summarize the herbarium and literature data on the species of clavarioid fungi recorded in Estonia. These data were compared with the biota of clavarioid fungi of adjacent areas or regions in the same

hemiboreal zone – in Leningrad district (Russia), Finland, Lithuania, and hemiboreal areas of the Ural Mountains (Russia). We hope, that this work should be helpful in creating the database of Estonian mycota and in completing the Estonian Red Data Book.

## MATERIALS AND METHODS

Analyse of 78 literature sources and a study of over 890 herbarium specimens collected in all parts of Estonia has been used for this study. The specimens hold in the mycological herbarium of the Institute of Agricultural and Environmental Sciences of the Estonian University of Life Sciences in Tartu (TAA; former Institute of Zoology and Botany of the Estonian Academy of Sciences) have been studied. Also, herbariums of the Helsinki University, Finland (H), V.L. Komarov Botanical Institute, St. Petersburg, Russia (LE), Botanical Institute of the Lithuanian Academy of Sciences, Vilnius (BILAS) and personal collection of Dr. Heikki Kotiranta, Helsinki (H.K.) were studied. Additional material was obtained during the field work of the author between 2005 and 2008 in Estonia; the specimens collected have been deposited in the mycological herbarium of the Institute of Plant and Animal Ecology of the Ural Division of the Russian Academy of Science, Ekaterinburg, Russia (SVER).

For identification of species several handbooks were used compiled by Corner (1950, 1970), Marr & Stuntz (1973), Petersen (1975, 1981), Berthier (1976), Jülich (1984), Hansen & Knudsen (1997) and Franchi & Marchetti (2001). The infrageneric classification of *Typhula* and *Pistillaria*, and *Clavariadelphus* and *Macrotyphula* is given in accordance with the monograph of Berthier (1976) and Petersen (1975), respectively. The corticioid genera *Ramaricium*, *Kavinia*, *Clavulicium*, and cantharelloid *Gomphus*, as well as heterobasidioid *Tremellodendropsis* (*Aphelaria*), *Calocera* and *Eocronartium* were excluded from this paper. Many species have been published under different names in the Estonian and other European literature; the synonyms are indicated under the correct names; as a rule, nomenclature used in <http://www.indexfungorum.org/Names/Names.asp> has been followed.

The taxa are given in alphabetical order; after the collecting site the type of vegetation, host(s) or substrate(s) and collector(s) are mentioned.

## Abbreviations used in the list:

County names: Harjumaa Co. – **Har**; Hiiumaa Co. – **Hii**; Ida-Virumaa Co. – **I-Vir**; Jõgevamaa Co. – **Jõg**; Järvamaa Co. – **Jär**; Läänemaa Co. – **Lää**; Lääne-Virumaa Co. – **L-Vir**; Pärnumaa Co. – **Pär**; Pölvamaa Co. – **Põl**; Raplamaa Co. – **Rap**; Saaremaa Co. – **Saa**; Tartumaa Co. – **Tar**; Valgamaa Co. – **Val**; Viljandimaa Co. – **Vil**; Võrumaa Co. – **Võr**.

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The words *spruce* and *Picea* refer to *Picea obovata*, *pine* and *Pinus* to *Pinus sylvestris*, *birch* to *Betula pendula* or *B. pubescens*, *aspen* or *Populus* to *Populus tremula*, *oak* or *Quercus* to *Quercus robur* and *elm* or *Ulmus* to *Ulmus laevis* and *U. scabrum*, respectively. Species new for Estonia are marked with asterisk (\*).

## RESULTS

Altogether 989 collections and observations were used by author, including information published in different literature sources. 103 species (belonging to 15 genera and 10 families) were detected from Estonia, including 46 species and the genus *Ceratellopsis* new for the country. Some specimens of the genera *Clavaria*, *Pterula*, *Ramaria* and *Typhula* deposited in the herbaria were remained unidentified. Some of these are probably still unknown taxa and will be described later. 21 species (20.6%) have been found only once, 15 (14.7%) – twice, and 10 species (9.8%) – three times. The 46 rare species (1–3 observations) form 45.1% of all the species, whereas 7 most common species (over 30 observations), form 6.8% and the rest (4–29

observations) 48.1%, respectively. The 56 common species include 54.9% of all observations.

ARTOMYCES PYXIDATUS (Pers.) Jülich

**Syn.:** *Clavicornia pyxidata* (Pers.: Fr.) Doty.

**Lit.:** Dietrich (1956); Lepik (1939); Parmasto (1953, 1963a, 1963b, 1965); Kalamees (1966a); Eesti... (1969); Corner (1970); Kalamees (1971, 1976); Kuthan (1989); Kotlaba (1990); Parmasto & Parmasto (2005).

Widespread in Estonia, but mostly on wood of aspen, very seldom of alders. Only two specimens known from pine wood (**I-Vir:** Valaste, mixed forest, 14 Aug 2006 A.S. (SVER(F) 67805). **Saa:** Ruhnu, 22 Jul 1980 *E.P.* (TAA 101436)).

\*CERATELLOPSIS SAGITTAEFORMIS (Pat.) Corner

**Hii:** Kõrgessaare, dry mixed pine-spruce forest with *Juniperus communis*, on rotten stems of *Artemisia* sp. and *Inula* sp., 25 Oct 2007 A.S. (SVER(F) 67880).

\*CLAVARIA AMOENOIDES Corner, Thind & Anand

**Saa:** Kuressaare, alvar habitat with *Rosa* spp., *Cotoneaster* sp., *Artemisia* spp., on soil, 10 Aug 2006 A.S. (SVER(F) 68097).

CLAVARIA ARGILLACEA Pers.: Fr.

**Lit.:** Rühl (1939); Kelder (1956); Parmasto (1963a, 1963b, 1965); Corner (1970).

**I-Vir:** Valaste, mixed forest with ferns, on soil, 14 Sep 2006 A.S. (SVER(F) 68049). **Pär:** Urissaare, on soil in a pine forest, 14 Oct 1950 *E.P.* (TAA 815); Ristiküla, 9 Nov 1951 *E.P.* (TAA 821). **Põl:** Ahja, Kärša, on the soil, 13 Sep 1956 *K.K.* (TAA 14580); Taevaskoja, on the ground, 16 Oct 1960 *A.E.* (TAA 14667).

CLAVARIA ARGILLACEA var. SPHAGNICOLA (Boud.) Corner

**Lit.:** Parmasto (1965).

**Põl:** in a forest between mosses and lichens, 6 Nov 1955 *K.K.* (TAA 14576). **Pär:** Halinga Comm., Virussaare, on the bog among mosses, 10 Oct 1958 *E.P.* (TAA 9550). **Tar:** Kolkja, western coast of the Peipsi Lake, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp., *Sorbus aucuparia*, on soil between mosses, 12 Aug 2006 A.S. (SVER(F) 68003). **Val:** Valga, on the bog between mosses, 2 Sep 1961 *E.P.* (TAA 14659).

\*CLAVARIA ASPERULOSPORA G.F. Atk.

**Hii:** Kõrgessaare, alvar habitat, dry mixed pine-spruce forest with *Juniperus communis* and *Artemisia* sp., *Inula* sp. et al., on humus, 25 Oct 2007 A.S. (SVER(F) 68028).

CLAVARIA FALCATA Pers.

**Syn.:** *C. acuta* Sowerby, *C. asterospora* Pat. **Lit.:** Parmasto (1965) Corner (1970).

**Hii:** Käina Comm., S part of Kassari Is., on the ground in *Juniperus communis* bushland, 17 Sep 2001 *I.P.* (TAA 181123). **I-Vir:** Valaste, mixed forest, on humus, 14 Aug 2006 A.S. (SVER(F) 67922). **Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak on calcareous soils, on soil among mosses, 23 Sep 2005 A.S. (SVER(F) 67663). **Tar:** Meeksi Comm., Järvselja forest div., on ground in a nemoral spruce forest, 22 Aug 2000 *I.P.* (TAA 169452).

CLAVARIA FRAGILIS Holmsk.

**Syn.:** *C. vermicularis* Scop. **Lit.:** Witkowski (1934); Pärtelpoeg (1939); Parmasto (1963a, 1965).

**Lää:** near Väike-Maarja, on ground, 4 Aug 1956 *M.K.* (TAA 14579). **Rap:** Kuusiku, open herb-rich forest with spruce, pine and oak, on calcareous soils, on humus, 23 Sep 2005 A.S. (SVER(F) 67822). **Saa:** Kaesla, on ground, 24 Aug 1960 *A. R.* (TAA 14578); on soil, 29 Aug 1960 *K.P.* (TAA 14577).

CLAVARIA FUMOSA Pers.: Fr.

**Lit.:** Parmasto (1963a, 1965).

**I-Vir:** Valaste, mixed forest with spruce, birch and aspen, on soil, 14 Aug 2006 A.S. (SVER(F) 67962). **Põl:** on ground between mosses, 15 Sep 1960 *A.E.* (TAA 1459). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on soil between mosses, 12 Aug 2006 A.S. (SVER(F) 67897).

\*CLAVARIA INCARNATA Weinm.

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak, on calcareous soils, on humus among mosses, 23 Sep 2005 A.S. (SVER(F) 68071).

\*CLAVARIA PURPUREA O.F. Müll.: Fr.

**Hii:** Kõrgessaare Comm., Mägipe, alvar spruce forest, on soil under *Picea abies*, 25 Oct 2007 A.S. (SVER(F) 67848). **Põl:** Veski, in a spruce forest of *Oxalis* type, on soil, 17 Aug 1977 *I. & E.P.* (TAA 52889). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on soil between mosses, 12 Aug 2006 A.S. (SVER(F) 67947). **Võr:** Antsla Comm., Karula National Park, Ähijärve, in a coniferous forest of *Oxalis* site type, on ground, 29 Aug 2003 *M.V.* (TAA(M) 182871).

\*CLAVARIA ROSEA Dalman: Fr.

**Hii:** Kõrgessaare, alvar habitats with spruce and juniper, on soil, 25 Oct 2007 A.S. (SVER(F) 67982).

## CLAVARIA STRAMINEA Cotton

**Lit.:** Kalamees & Kollom (1981); Kalamees & Raitviir (1979).

No specimens in the TAA(M).

## \*CLAVARIA ZOLLINGERI Lév.

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak, on calcareous soils, on humus among mosses, 23 Sep 2005 A.S. (SVER(F) 67832).

## CLAVARIADELPHUS LIGULA (Schaeff : Fr.) Donk

**Lit.:** Dietrich (1856); Witkowski (1934); Lepik (1936, 1940); Pärtelpeog (1939); Padernik (1942); Marland (1956); Leisner (1962); Parmasto (1953, 1963a, 1965, 1970); Kalamees (1966a, 1966b), Jaagomäe (1968, 1976, 1979); Eesti...(1969); Kalamees et al. (1976); Parmasto & Parmasto (1987); Kalamees & Liiv (2005).

**Hii:** Köpu Penins., Linnaru forest reserve, on coniferous litter in a spruce forest of *Oxalis acetosella* type, 3 Sep 2000 *E.P.* (TAA 180197).

**I-Vir:** Kohtla-Järve, on coniferous litter, 3 Aug 1961 *L.J.* (TAA 46486); Kohtla-Järve, Kuremäe, on pine-cone, 20 Sep 1987 *B.K.* (TAA 116791).

**L-Vir:** Rakvere, Roela, on dead needles in the pine-spruce forest, 25 Sep 1965 *E.P.* (TAA(M) 193521). **Pär:** Jäärja forestry, in a pine forest, 25 Sep 1999 *M.V.* (TAA 172426). **Põl:** coniferous forest, 4 Sep 1957 *M.K.* (TAA 14673). **Saa:** Kuressaare, Sörve, on spruce litter in pinetum *vaccinosum*, 11 Sep 1984 *E.P.* (TAA 105898).

**Rap:** Rapla, on ground, 21 Sep 1984 *I. Parmasto* (TAA 125668). **Tar:** on ground in Pinetum *vaccinosum*, 8 Sep 1984 *E.P.* (TAA 105885); Kolkja, western coast of the Peipsi Lake, on soil in mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp., *Sorbus aucuparia* between mosses, 12 Aug 2006 A.S. (SVER(F) 67865). **Val:** Taheva, spruce forest of *Vaccinium myrtillus* site type, 6 Sep 1957 *E.P.* (TAA 6715); Põlva Co., Taevaskoja, 7 Oct 1957 *M.K.* (TAA 14669). **Vil:** Venevere, on conifer litter in pine-spruce forest, 24 Jul 1960 *T.F.* (TAA(M) 193522).

## CLAVARIADELPHUS PISTILLARIS (L.: Fr.) Donk

**Lit.:** Dietrich (1856); Leisner (1962); Parmasto (1963a, 1965); Kalamees (1966a); Jaagomäe (1968, 1976, 1979); Eesti...(1969); Kalamees & Kalamees (1973); Kalamees (1990); Kalamees & Liiv (2005).

**Hii:** Tornimägi, in a spruce forest, on soil, 5 Sep 1970 *H.-E.R.* (TAA(M) 193531); Kõrgessaare Comm., NW of Mägipe, under *Picea abies* in an alvar spruce forest, 15 Sep 2001 *I.P.* (TAA 181086).

**I-Vir:** Valaste, mixed forest, on humus, 14 Aug 2006 A.S. (SVER(F) 68022). **Lää:** Venevere, 6 Sep 1972 *K.K.* (TAA 82001). **L-Vir:** Rakvere Comm., Lasila, in a spruce forest of *Hepatica* site type, on soil, 21 Aug 2003 *I.P.* (TAA 181305). **Pär:** Laiksaare, spruce forest of *Oxalis* site type, on ground, 10 Aug 1953 *E.P.* (TAA 1347); Varbla, Matu, on soil, 13 Sep 1980 *L.J.* (TAA 93505). **Põl:** Kanariku, in a pine forest, on ground, 24 Aug 1967 *I.K.* (TAA 162585). **Saa:** Kangruselja, on ground, 3 Sep 1953 *E.P.* (TAA 1727); Torgu Comm., SE of Kargi, in a spruce forest, on soil, 25 Aug 1998 *E.P.* (TAA 167923); Kaarma Comm., Loode oak forest, 27 Sep 2004 *I.S. & K.K.* (TAA(M) 185783).

## CLAVARIADELPHUS SACHALINENSIS (Imai) Corner

**Rap:** in a spruce forest of *Oxalis* site type, on litter of rotten needles, 16 Sep 1956 *E.P.* (TAA 4513).

## CLAVARIADELPHUS TRUNCATUS (Quél.) Donk

**Lit.:** Parmasto (1962, 1965); Kalamees (1966a); Eesti... (1969); Kalamees et al. (1976); Kalamees & Liiv (2005).

**Har:** Paunküla, Puusepa forest, on ground in a spruce forest, 27 Aug 1962 *T.L.* (TAA 98025).

**Rap:** Kuusiku, 13 Sep 1956 *E.P.* (TAA 14514); Märjamaa, 27 Aug 1967 (TAA 6923); Jalase, in an alvar forest, on soil, 22 Sep 1984 *E.P. & K.K.* (TAA 106007); Hageri-Lümandu, mixed spruce forest, on soil, 6 Oct 1995 *M.Ö.* (TAA 165063); Kuusiku, mixed herb-rich forest with spruce, pine and oak, on calcareous soils, on humus among mosses, 23 Sep 2005 A.S. (SVER(F) 68084). **Saa:** Kihelkonna Forest Div., Kuumi, 5 Aug 1998 *M.V.* (TAA 171979); Torgu Comm., W of Viieristi, 27 Aug 1998 (TAA 167964); Kuressaare Comm., S of Mullutu, on ground under *Tilia cordata* in a *Quercus* forest, 11 Sep 1998 *I.P.* (TAA 169164). **Tar:** Vana-Kuuste park, 20 Sep 1958 *E.P.* (TAA 14510);

## CLAVULINA AMETHYSTINA (Bull.: Fr.) Donk

**Lit.:** Rühl (1939); Parmasto (1965).

**Hii:** Kõrgessaare, alvar habitats with spruce and juniper, on soil, 25 Oct 2007 A.S. (SVER(F) 68062). **Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak, on calcareous soils, on stony humus between grasses and rotten leaves, 23 Sep 2005 A.S. (SVER(F) 67906). **Saa:** Kuressaare, alvar habitat with *Quercus*, *Rosa*, *Cotoneaster*, *Artemisia* spp., on soil, 10 Aug 2006 A.S. (SVER(F) 67971).

## CLAVULINA CINEREA (Bull.: Fr.) J. Schröt.

**Lit.:** Witkowski (1934); Parmasto (1963a, 1965); Kalamees & Raitviir (1979); Kalamees & Kollom

(1981); Parmasto & Parmasto (2005).  
Widespread and common in Estonia.

CLAVULINA CORALLOIDES (L.) J. Schröt.

**Syn.:** *Clavaria cristata* (Holmsk.) Pers.

**Lit.:** Dietrich (1856); Lepik (1936, 1938, 1940); Rühl (1939); Parmasto (1963a, 1965); Kelder (1956); Eesti... (1969); Kalamees et al. (1976); Kalamees & Raitviir (1979); Kalamees & Kollom (1981); Kalamees & Vaasma (1989); Parmasto & Parmasto (2005).

Common in Estonia, especially near the sea in alvar and meadow habitats.

CLAVULINA RUGOSA (Bull.: Fr.) J. Schröt.

**Lit.:** Dietrich (1856); Parmasto (1963a, 1965); Kalamees & Raitviir (1979); Kalamees & Kollom (1981); Parmasto & Parmasto (2005).

**Rap:** Käända, Sooniste, in a spruce forest on ground, 16 Sep 1971 K.K. (TAA 81682); *ibid.*, 13 Sep 1996 I.P. (TAA 164936). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on soil between mosses, 12 Aug 2006 A.S. (SVER(F) 68099). **Val:** Karula, on ground; 31 Aug 1982 S.V. (TAA 114865).

CLAVULINOPSIS CORNICULATA (Pers.: Fr.) Corner

**Lit.:** Dietrich (1856); Witkowski (1934); Parmasto (1963a, 1965); Red Data Book (1999).

**Hii:** Mägipe, alvar habitats with spruce and juniper, 29 Sep 2007 A.S. & H.K. (SVER(F) 68015).

**I-Vir:** Valaste, mixed forest, on stony soil among mosses and dead grasses, 14 Aug 2006 A.S. (SVER(F) 67900); Narva, Tuulukse, mixed forest with spruce, pine, birch and aspen, on soil, 15 Aug 2006 A.S. (SVER(F) 67943). **Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak, on calcareous soils, on humus among mosses, 23 Sep 2005 A.S. (SVER(F) 67856). **Saa:** Mullutu near Kuressaare, in a *Quercus* forest, on ground, 23 Sep 1992 K.K. (TAA 145553); Abruksa Is., in a mixed forest, on soil, 14 Sep 1993 I.P. & E.P. (TAA 152728); S of Mullutu, in an oak forest, on ground, 11 Sep 1998 I.P. (TAA 169167); *ibid.*, 23 Oct 2007 A.S. (SVER(F) 67815).

CLAVULINOPSIS FUSIFORMIS (Fr.) Corner

**Lit.:** Parmasto (1961, 1963a, 1965).

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak, on calcareous soils, on soil among mosses, 23 Sep 2005 A.S. (SVER(F) 67881). **Saa:** Kuressaare, alvar habitat with oak, *Rosa* spp., *Cotoneaster* sp. and *Artemisia* spp., on soil, 10 Aug 2006 A.S. (SVER(F) 67972).

CLAVULINOPSIS HELVOLA (Pers.: Fr.) Corner

**Lit.:** Parmasto (1963a, 1965).

**Hii:** Kõrgessaare, alvar habitats with spruce and juniper, on soil, 25 Oct 2007 A.S. (SVER(F) 67919). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on soil between mosses, 12 Aug 2006 A.S. (SVER(F) 68057).

\*CLAVULINOPSIS LAETICOLOR (Berk. & M.A. Curt.) R.H. Petersen

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak, on calcareous soils, on soil between mosses, 23 Sep 2005 A.S. (SVER(F) 67806). **Saa:** Kuressaare, alvar habitat with *Quercus*, *Rosa*, *Cotoneaster* and *Artemisia*, on calcareous soil, 10 Aug 2006 A.S. (SVER(F) 67932). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on soil between mosses, 12 Aug 2006 A.S. (SVER(F) 68077).

\*CLAVULINOPSIS LUTEALBA (Rea) Corner

**Syn.:** *C. filipes* Corner

**Hii:** Kõrgessaare, alvar habitats with spruce and juniper, on soil and coniferous litter, 25 Oct 2007 A.S. (SVER(F) 68004). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on fallen rotten needles and coniferous twigs, 12 Aug 2006 A.S. (SVER(F) 67959).

\*CLAVULINOPSIS RUFIPES (G. F. Atk.) Corner

**Syn.:** *C. microspora* (Joss.) Corner.

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine, oak and ferns, calcareous soils, on litter with dead fern petioles, 23 Sep. 2005 A.S. (SVER(F) 68043).

\*CLAVULINOPSIS UMBRINELLA (Sacc.) Corner

**Syn.:** *C. cinereoides* (G. F. Atk.) Corner.

**Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on soil between mosses, 12 Aug 2006 A.S. (SVER(F) 68088).

LENTARIA AFFLATA (Lager) Corner

**Syn.:** *L. albo-vinacea* Pilát. **Lit.:** Parmasto (1965), Corner (1970).

**I-Vir:** Valaste, mixed forest, on a fallen trunk of aspen, 14 Aug 2006 A.S. (SVER(F) 67907). **Jõg:** 2.5 km NW of Jõgeva, in a spruce forest of *Oxalis* site type, on a trunk, 11 Sep 1960 K.K. (TAA 71771). **Saa:** S of Mullutu, oak-hazzel forest, on a brunch of *Corylus avellana*, 11 Sep 1998 I.P. (TAA 169162).

LENTARIA BYSSISEDA (Pers.: Fr.) Corner

**Syn.:** *L. soluta* (P. Karst.) Pilát. **Lit.:** Parmasto (1963a, 1965); Kalamees & Raitviir (1979); Kalamees & Kollom (1981).

**L-Vir:** Vinni oak forest, on decaying twigs of oak, 10 Oct 1991 *I.P.* (TAA 152258). **Saa:** Kuressaare, alvar habitat with *Quercus*, *Rosa* spp., *Cotoneaster* sp., *Artemisia* spp., on oak twigs, 10 Aug 2006 A.S. (SVER(F) 67849). **Tar:** Kolkja, mixed forest, on a fallen trunk of spruce, 12 Aug 2006 A.S. (SVER(F) 68016).

\*LENTARIA DENDROIDEA (Fr.) J.H. Petersen

**I-Vir:** Valaste, mixed forest, on coniferous litter among mosses, 14 Aug 2006 A.S. (SVER(F) 68000). **Tar:** Tõravere, on ground in a pine-birch forest, 28 Jul 1996 *M. Õpik* (TAA 165086); Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on coniferous litter, 12 Aug 2006 A.S. (SVER(F) 67821).

LENTARIA SUBCAULESCENS (Rebent.) Rauschert

**Syn.:** *L. epichnoa* (Fr.) Corner. **Lit.:** Parmasto (1963a, 1965), Corner (1950, 1970).

**Hii:** Kõrgessaare, spruce-pine forest with juniper, on fallen brunch of spruce, 25. Oct 2007 A.S. (SVER(F) 67994). **Tar:** Kolkja, western coast of the Peipsi Lake, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp., *Sorbus aucuparia*, on spruce trunk, 12. Aug 2006 A.S. (SVER(F) 67886).

MACROTYPHULA FISTULOSA (Holmsk.) R. H. Petersen var. CONTORTA (Holmsk.) Nannf. & L. Holm

**Syn.:** *Clavaria contorta* Holmsk.

Common species in Estonia.

MACROTYPHULA FISTULOSA (Holmsk.) R. H. Petersen var. FISTULOSA

**Syn.:** *Clavaria fistulosa* Holmsk. **Lit.:** Dietrich (1856, 1859); Witkowski (1934); Leisner (1959); Parmasto (1963a, 1965).

Common species in Estonia.

MACROTYPHULA JUNCEA (Fr.) Berthier

**Syn.:** *Typhula filiformis* Fr.

**Lit.:** Parmasto (1959, 1963a, 1965); Kalamees (1966); Kalamees et al. (1976); Kalamees & Raitviir (1979); Kalamees & Kollom (1981).

**I-Vir:** Boroni, deciduous forest, on fallen leaves of *Populus tremula* and *Betula pendula*, 3 Oct 1967 *E.P.* (TAA 151717). **Jär:** Ambla Comm., Rava, 14 Oct 2004 *E.P.* (TAA(M) 189399). **Rap:** Kabala, leaves of *Populus tremula*, 22 Sep 1984 *S.V.* (TAA 105993). **Vil:** Vastemõisa Comm., Sandra, Kuuraniidu, drained peatland forest, 16 Oct

2001 *M.V.* (TAA 182609).

Common species in Estonia.

\*MUCRONELLA BRESADOLAE (Quél.) Corner

**Tar:** Elva comm., Kirepi, mixed forest with spruce, birch, pine and aspen, on a decayed polypore covered with mosses, 1 May 2008 A.S. (SVER(F) 68065).

MUCRONELLA CALVA (Alb. & Schwein.) Fr.

**Lit.:** Parmasto (1963a, 1965); Parmasto & Parmasto (2005).

**Hii:** Kõrgessaare, alvar habitats with spruce and juniper, on a buried under mosses juniper, 25 Oct 2007 A.S. (SVER(F) 67979). **Rap:** Kuusiku, mixed herb-rich alvar forest with spruce, pine and oak, on a dead erect decorticated pine, 23 Sep 2005 A.S. (SVER(F) 67828). **Tar:** Järvselja Nature Reserve, on a decaying trunk of *Populus tremula*, 13 Oct 1969 *E.P.* (TAA 54134).

\*MUCRONELLA FLAVA Corner

**I-Vir:** Valaste, mixed forest, on a fallen trunk of pine, 14 Aug 2006 A.S. (SVER(F) 68011). **Põl:** Kiidjärve, on a decaying trunk of pine, 8 Aug 1975 *I.P.* (TAA 99923).

\*MULTICLAVULA CORYNOIDES

**Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp., *Sorbus aucuparia*, *Salix* spp., on soil with algae, 12 Aug 2006 A.S. (SVER(F) 67939).

MULTICLAVULA DELICATA (Fr.) R.H. Petersen

**Syn.:** *Lentaria delicata* (Fr.) Corner. **Lit.:** Dietrich (1859).

No specimens in TAA(M); occurrence in Estonia is doubtful.

MULTICLAVULA MUCIDA (Pers.: Fr.) R.H. Petersen

**Lit.:** Dietrich (1856); Juhend... (1963); Parmasto (1963a, 1963b, 1965).

**I-Vir:** Kohtla-Järve, on a trunk of *Populus tremula*, 3 Aug 1962 *E.P.* (TAA 14953). **Pär:** Riimaru, in a spruce forest, on a fallen trunk of *Betula pendula*, 23 Aug 1993 *E.P.* (TAA 152510); Jäärja Forest Div., on a fallen trunk of *Populus tremula*, 26 Sep 1999 *M.V.* (TAA 172474). **Rap:** Käända, on a fallen trunk of spruce in a spruce forest, 13 Sep 1996 *E.P.* (TAA 154077). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on a fallen decorticated aspen covered with algae, 12 Aug 2006 A.S. (SVER(F) 67995). **Vil:** Maassaare, in a spruce forest of *Vaccinium myrtillus* site type, on a trunk of aspen, 27 Aug 1993 *E.P.* (TAA 152595).

MULTICLAVULA VERNALIS (Schwein.) R.H. Petersen  
**Lit.:** Parmasto (1963a, 1963b, 1965); Red Data Book (1999).

**Hii:** Kõrgessaare, alvar habitats with spruce and juniper, on soil between herbs and dead leaves, 25 Oct 2007 A.S. (SVER(F) 68044). **I-Vir:** Valaste, mixed herb-rich forest, on soil, 14 Aug 2006 A.S. (SVER(F) 68085).

PTERULA GRACILIS (Desm. & Berk.) Corner

**Syn.:** *Cnazonaria aculina* (Quel.) Donk, *Pistillaria juncicola* Bourdot & Galzin, *Ceratellopsis kubicckae* Pilát. **Lit.:** Parmasto (1963a, 1965).

**I-Vir:** Valaste, mixed herb-rich forest, on rotten *Juncus* sp., 14 Aug 2006 A.S. (SVER(F) 69012). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on rotten grasses and leaves in a moisture habitat, 12 Aug 2006 A.S. (SVER(F) 67908).

PTERULA SUBULATA Fr.

**Syn.:** *P. multifida* (Chevall.) Fr. **Lit.:** Rühl (1939); Parmasto (1965).

**Har:** Anija, Raudoja, mesotrophic boreal spruce forest of *Oxalis* site type, on litter, 28 Aug 2003 K.K. & V.L. (TAA 176337). **I-Vir:** Bironi Nature Reserve, in a spruce forest of *Oxalis* site type, on soil, 4 Oct 1967 M.M. (TAA 18926); Valaste, mixed luxuriant forest, on humus, 14 Aug 2006 A.S. (SVER(F) 67973). **L-Vir:** Ratva Bog, in a nemorose forest, on soil, 25 Sep 1970 I.P. (TAA 54725). **Rap:** Märjamaa Comm., Vardi Forest Reserve, on ground between roots of *Picea abies* in an alvar spruce forest, 6 Oct 1998 U.T. (TAA 174469); Kuusiku, mixed herb-rich forest with spruce, pine and oak on calcareous soils, on soil among mosses, 23 Sep 2005 A.S. (SVER(F) 67866).

RAMARIA ABIETINA (Pers.: Fr.) Quél.

**Syn.:** *Clavaria abietina* Pers., *C. ochraceovirens* Jungh., *C. virescens* Gramberg. **Lit.:** Dietrich (1856, 1859); Witkowski (1934); Leisner (1962); Parmasto (1963a, 1963b, 1965, 1970); Kalamees (1966a); Kalamees & Raitviir (1979); Kalamees & Kollom (1981); Parmasto & Parmasto (2005).

**Hii:** Tahkuna, on ground in a paludified spruce forest, 13 Sep 2001 I. Saar (TAA 181054); Kõrgessaare Comm., Ristna, on litter under *Picea abies* in a dry pine forest, 15 Sep 2001 I.P. (TAA 181102). **Jõg:** Saare, Mädaoïdu, on ground in a spruce forest of *Vaccinium myrtillum* site type, 2 Oct 1984 I.P. (TAA 106046). **Pär:** W of Surju, on ground in a spruce forest, 18 Sep 1988 I.P. (TAA 126414). **Põl:** Taevaskoja, on ground in spruce forest, 21 Aug 1985 I.P. (TAA 125749). **Saa:** Muhu

Comm., Kessulaid Is., on forest litter under *Picea* trees in a spruce forest, 28 Aug 1998 E.P. (TAA 174043). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on fallen rotten needles, 12 Aug 2006 A.S. (SVER(F) 67920). **Val:** Palupera, on ground in a pine forest, 27 Aug 1993 I.P. (TAA 126921). Common species in the hemiboreal zone. Wide-spread in Estonia, Latvia, Finland, Russia.

RAMARIA APICULATA (Fr.: Fr.) Donk

**Lit.:** Dietrich (1859); Parmasto & Parmasto (2005).

**Hii:** Kõrgessaare, spruce-pine forest with juniper, on a fallen corticated trunk of *Picea abies*, 25 Oct 2007 A. S. (SVER(F) 67850). **I-Vir:** Valaste, mixed forest, on a fallen trunk of spruce, 14 Aug 2006 A.S. (SVER(F) 68058). **Saa:** Ruhnu Is., NW of Överkirke, on a fallen rotten trunk of *Picea abies* in a pine forest of *Vaccinium vitis-idaea* site type, 15 Sep 1998 E.P. (TAA 174325).

RAMARIA BOTRYTIS (Pers.: Fr.) Ricken

**Lit.:** Dietrich (1856); Lepik (1936); Padernik (1942); Parmasto (1963a, 1965), Corner (1970). **Hii:** Kärðla, alvar habitat with spruce and juniper, on soil and coniferous litter, 25 Oct 2007 A.S. (SVER(F) 68013). **Rap:** Saunaküla, mixed herb-rich forest of spruce, pine and oak with ferns, on humus among mosses, 24 Sep 2005 A.S. (SVER(F) 67933). **Saa:** NE of Kooru, on ground in a pine forest of *Calluna* site type, 25 Sep 2001 I.P. (TAA); Kärðla Comm., N of Kandla, on ground in an alvar pine forest of *Arctostaphylos uva-ursi* site type, 26 Sep 2001 E.P. (TAA 180783); Kandla, on ground in a pine forest of *Cladina* site type, 25 Sep 2004 I.S. (TAA 185724);

RAMARIA BOTRYTOIDES (Peck.) Corner

**Lit.:** Corner (1970).

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak on calcareous soils, on soil among mosses, 23 Sep 2005 A.S. (SVER(F) 67864).

\*RAMARIA BROOMEI (Cotton & Wakef.) R.H. Petersen

**Saa:** Kuressaare, alvar habitat with *Quercus*, *Rosa*, *Cotoneaster*, *Artemisia*, on calcareous soil, 10 Aug 2006 A.S. (SVER(F) 67981).

RAMARIA CONJUNCTIPES (Coker) Corner

**Lit.:** Parmasto (1963a, 1965).

No specimens in the herbarium TAA(M); occurrence in Estonia is doubtful.

\*RAMARIA CORRUGATA (P. Karst.) Schild

**Hii:** Tahkuna, on ground in a paludified spruce forest, 13 Sep 2001 *I.P.* (TAA 181056). **L-Vir:** Assamalla, in a spruce forest of *Oxalis* site type, on decaying needles of spruce, 13 Sep 1980 *E.P.* (TAA 101455). **Rap:** Tori oak forest near Raka vilage, on ground in a spruce forest of *Hepatica* site type, 6 Oct 1998 *I.P.* (TAA 174395). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp., *Sorbus aucuparia*, on fallen rotten needles, 12 Aug 2006 A.S. (SVER(F) 68048). Common species in Estonia.

\*RAMARIA DECCURENS (Pers.) R.H. Petersen

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak on calcareous soils, on soil among mosses, 23 Sep 2005 A.S. (SVER(F) 67814).

RAMARIA EUMORPHA (P. Karst.) Corner

**Syn.:** *Clavaria invalii* Cotton & Wakef. **Lit.:** Parmasto (1961, 1963, 1965); Kalamees, (1966a), Jaagomae (1968, 1976, 1979); Kalamees et al. (1976); Kalamees & Raitviir (1979); Kalamees & Kollom (1981).

**Har:** Kernu Comm., Mõnuste, on soil in an alvar spruce forest, 5 Sep 1994 *E.P.* (TAA 153922). **Jär:** Illevere, in a pine forest of *Oxalis* site type, 12 Aug 1993 *I.P.* (TAA 152417). **Tar:** Unikula, on ground in a spruce forest of *Oxalis* site type, 11 Sep 1970 *E.P.* (TAA 54570). **Vil:** Vennissaare, on ground in a pine forest of *Vaccinium myrtillus* site type, 23 Aug 1993 *E.P.* (TAA 152494).

One of the most common *Ramaria* species in Estonia.

\*RAMARIA FENNICA (P. Karst.) Ricken

**Hii:** Kõrgessaare, NW of Mägipe, on ground in alvar *Picea* forest, 15 Sep 2001 coll. *I.P.*, det. *I.K.* (TAA 181092). **Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak on calcareous soils, on soil among mosses 23 Sep 2005 A.S. (SVER(F) 67882).

RAMARIA FLACCIDA (Fr.) Bourd.

**Lit.:** Dietrich (1856); Rühl (1939); Parmasto (1963a, 1965).

One of the most common *Ramaria* species in Estonia.

RAMARIA FLAVA (Schaeff.: Fr.) Quél.

**Lit.:** Dietrich (1856); Lepik (1936); Padernik (1942); Kalamees (1958, 1963, 1969); Parmasto (1963a, 1965); Kalamees & Vaasma (1980, 1982); Kalamees (1985); Kalamees & Saar (2006).

**Saa:** Kuressaare, N of Kudjape, on soil in a

*Quercus robur* forest, 27 Aug 1998 *E.P.* (TAA 167968). **Hii:** Kõrgessaare, NW of Mägipe, on ground in an alvar *Picea* forest, 15 Sep 2001 *I.P.* (TAA 181090); Pühalepa Comm., Palade, alvar forest with *Picea abies*, *Pinus sylvestris* and *Juniperus communis*, on soil, 24 Oct 2007 A.S. (SVER(F) 67996). **I-Vir:** Valaste, mixed luxuriant forest, on soil among mosses and herbs, 14 Aug 2006 A.S. (SVER(F) 67899).

\*RAMARIA FLAVESCENS (Schaeff.) R.H. Petersen

**Hii:** Pühalepa Comm., Nõmba, alvar habitats with spruce and juniper, on calcareous soil among mosses and herbs, 25 Oct 2007 A.S. (SVER(F) 68098). **Saa:** Kuressaare, alvar habitat with *Quercus*, *Rosa*, *Cotoneaster* and *Artemisia*, on calcareous soil, 10 Aug 2006 A.S. (SVER(F) 68005).

RAMARIA FLAVOBRUNNESCENS (G.F. Atk.) Corner

**Lit.:** Corner (1970).

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak on calcareous soils, on soil among mosses, 23 Sep 2005 A.S. (SVER(F) 67944).

\*RAMARIA FORMOSA (Pers.: Fr.) Quél.

**Hii:** Pühalepa Comm., Nõmba, alvar habitats with spruce and juniper, on calcareous soil among mosses and herbs, 25 Oct 2007 A.S. (SVER(F) 67909). **I-Vir:** Valaste, mixed forest, on rich soil between mosses and dead grasses, 14 Aug 2006 A.S. (SVER(F) 68023). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on soil between mosses, 12 Aug 2006 A.S. (SVER(F) 67834).

RAMARIA GRACILIS (Pers.: Fr.) Quél.

**Lit.:** Parmasto (1963a, 1965); Kalamees & Raitviir (1979); Kalamees & Kollom (1981); Parmasto & Parmasto (1987); Kalamees (1990).

**I-Vir:** Vaivara Comm., Tuulukse, mixed forest with spruce, pine, birch and aspen, on rotten needles, 15 Aug 2006 A.S. (SVER(F) 67831). **Jõg:** Mõisamaa, 11 Sep 1960 *K.K.* (TAA 71769). **Tar:** Kolkja, mixed forest, on fallen rotten needles, 12 Aug 2006 A.S. (SVER(F) 67940). **Võr:** Pähni, in a pine forest, on soil, 6 Sep 1985 *I.P.* (TAA 125764). **Saa:** Kihelkonna forest, in a pine forest of *Vaccinium vitis-idaea* site type, on coniferous litter, 14 Aug 1998 *M.V.* (TAA 171971).

One of the most common *Ramaria* species in Estonia.

\*RAMARIA MAGNIPES Marr & D.E. Stuntz

**Rap:** Kuusiku, mixed herb-rich forest with

spruce, pine and oak, on soil among mosses, 23 Sep 2005 A.S. (SVER(F) 67874). **Saa:** Kuressaare, alvar habitat with *Quercus*, *Pinus*, *Rosa*, *Cotoneaster*, *Artemisia*, on soil, 10 Aug 2006 A.S. (SVER(F) 67988).

\*RAMARIA OBTUSISSIMA (Peck) Corner

**I-Vir:** near Kohtla-Järve, on ground in a mixed forest, 14 Aug 1961 coll. M.K., det. E.P. (TAA 14744). **Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak on calcareous soils, on soil among mosses, 23 Sep 2005 A.S. (SVER(F) 67860).

\*RAMARIA SANGUINEA (Pers.) Quél.

**Syn.:** *Clavaria botrytis* var. *sanguinea* (Pers.) Pers.

**Põl:** Meenikonnu Landscape Reserve, on ground under a *Pinus sylvestris* trunk in a pine forest of *Vaccinium vitis-idaea* site type, 13 Sep 1991 I.P. & E.P. (TAA 169466). **Rap:** Kuusiku, mixed nemoral herb-rich pine-oak forest on calcareous soils among mosses, 23 Sep 2005 A.S. (SVER(F) 67925).

\*RAMARIA PALLIDA (Schaeff.) Ricken

**Syn.:** *Ramaria mairei* Donk. **Lit.:** Parmasto (1963a, 1965).

**Hii:** Kõrgessaare Comm., Lauka, alvar habitats with spruce and juniper, on soil, 25 Oct 2007 A.S. (SVER(F) 67983). **Pär:** on ground, 9 Aug 1960 coll. A.R., det. E.P. (TAA 833/14597). **Saa:** Kuressaare, alvar habitat with *Quercus*, *Rosa*, *Cotoneaster* and *Artemisia*, on calcareous soil, 10 Aug 2006 A.S. (SVER(F) 67810).

RAMARIA PUSILLA Corner

**Lit.:** Corner (1970).

No specimens in the herbarium TAA(M); occurrence in Estonia is doubtful.

\*RAMARIA RASILISPORA Marr & D.E. Stuntz

**I-Vir:** Valaste, mixed luxuriant forest with *Picea abies*, *Pinus sylvestris*, *Betula pendula*, *Populus tremula* and *Sorbus aucuparia*, on soil, 14 Aug 2006 A.S. (SVER(F) 68036).

\*RAMARIA RUBELLA (Schaeff.) R.H. Petersen

**Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on a stump of spruce under moss carpet, 12 Aug 2006 A.S. (SVER(F) 67951).

\*RAMARIA SPINULOSA (Pers.: Fr.) Quél.

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine, oak and ferns on calcareous soils, on humus between ferns, 23 Sep 2005 A.S. (SVER(F) 67891).

RAMARIA STRICTA (Pers.: Fr.) Quél.

**Lit.:** Dietrich (1856, 1859); Witkowski (1934); Lepik (1940); Parmasto (1963a, 1965); Parmasto & Parmasto (2005); Kalamees & Saar (2006).

**I-Vir:** Vaivara Comm., Tuulukse, mixed forest with *Picea abies*, *Pinus sylvestris* and *Betula pendula*, on a buried pine branch, 15 Aug 2006 A.S. (SVER(F) 67843). **Saa:** Sõrve, on litter in a *Picea abies* forest of *Oxalis* site type, 9 Sep 1953 E.P. (TAA 1924); Torgu, Kargi, on spruce needles in a young spruce forest, 25 Aug 1998 E.P. (TAA 167938); Kärkla, Jõempa, on soil in a pine forest of *Cladina* type, 10 Sep 1998 E.P. (TAA 174227); Ruhnu Is., Norrkeld, on a rotten stump of pine in a mixed forest, 12 Sep 1998 E.P. (TAA 174254). **Tar:** Järvelja, on rotten branches, 03 Oct 1991 I.P. (TAA 126774); Vara Comm., Selgise, on forest litter under spruce trees, 23 Jul 1998 I.P. (TAA 167807). **Vil:** Tipu, on litter in a pine forest, 24 Aug 1993 E.P. (TAA 152522).

RAMARIA SUECICA (Fr.: Fr.) Donk

**Lit.:** Parmasto (1963a, 1965); Parmasto & Parmasto (2005).

One of the most common *Ramaria* species in Estonia.

\*RAMARIA TESTACEOFLAVA (Bres.) Corner

**Hii:** Kõrgessaare, alvar habitats with spruce and juniper, on soil and coniferous litter, 25 Oct 2007 A.S. (SVER(F) 67870). **Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak with ferns and grasses on calcareous soils, on humus, 23 Sep 2005 A.S. (SVER(F) 67819).

\*RAMARIOPSIS BIFORMIS (G. F. Atk.) R.H. Petersen

**Syn.:** *Clavulinopsis biformis* (G.F. Atk.) Corner.

**Har:** Kuusalu Comm., Kaberla, mixed herb-rich forest with *Pinus sylvestris*, *Betula pendula*, *Sorbus aucuparia* and *Salix* spp., on soil, 21 Sep 2005 A.S. (SVER(F) 67914). **Hii:** Kärkla, alvar habitats with spruce and juniper, on soil and leaf litter, 25 Oct 2007 A.S. (SVER(F) 68032). **Rap:** Kuusiku, mixed herb-rich forest with spruce, pine, oak, ferns and grasses on calcareous soils, on litter, 23 Sep 2005 A.S. (SVER(F) 67929).

\*RAMARIOPSIS CROCEA (Pers.: Fr.) Corner

**Hii:** Kärkla, alvar herb-rich habitat with spruce and juniper, on soil and litter, 25 Oct 2007 A.S. (SVER(F) 67903). **Saa:** Kuressaare, alvar habitat with *Quercus*, *Rosa*, *Cotoneaster* and *Artemisia*, on calcareous soil, 10 Aug 2006 A.S. (SVER(F) 67826).

RAMARIOPSIS KUNZEI (Fr.) Corner

**Lit.:** Parmasto (1963a, 1965).

**Har:** Harku park, on ground, 27 Aug 1958 *H.-E.R.* (TAA 14569); Põlvamaa Co., Liiva, in a pine forest, 18 Sep 1959 *K.K.* (TAA 71403). **Hii:** Kõrgessaare, alvar habitats with spruce and juniper, on soil, 25 Oct 2007 A.S. (SVER(F) 68103). **Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak on calcareous soils, on soil among mosses and leaf litter, 23 Sep 2005 A.S. (SVER(F) 67955). **Saa:** S of Mullutu (near Kuressaare), on ground in an oak forest, 11 Sep 1998 *I.P.* (TAA 169160).

\*RAMARIOPSIS PULCHELLA (Boud.) Corner

**Hii:** Kõrgessaare, alvar forest with spruce and juniper, on soil and grass or herbs litter, 25 Oct 2007 A.S. (SVER(F) 67888). **Saa:** Kuressaare, alvar habitat with *Quercus*, *Rosa*, *Cotoneaster* and *Artemisia*, on calcareous soil, 10 Aug 2006 A.S. (SVER(F) 67840).

\*RAMARIOPSIS SUBTILIS (Pers.) R.H. Petersen

**Syn.:** *Clavulinopsis subtilis* (Pers.: Fr.) Corner.

**Hii:** Kõrgessaare, alvar forest with spruce and juniper, on soil and litter, 25 Oct 2007 A.S. (SVER(F) 68007). **Rap:** Kuusiku, mixed herb-rich forest with spruce, pine, oak, ferns and grasses on calcareous soils, on litter of dead fern petioles, 23 Sep 2005 A.S. (SVER(F) 67893). **Tar:** Kolkja, luxuriant forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on mixed litter, 12 Aug 2006 A.S. (SVER(F) 67965).

\*RAMARIOPSIS TENUICULA R.H. Petersen

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak on calcareous soils, on soil between mosses, 23 Sep 2005 A.S. (SVER(F) 67877).

\*RAMARIOPSIS TENUIRAMOSA Corner

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine, oak, ferns and grasses on calcareous soils, on litter of dead ferns petioles, 23 Sep 2005 A.S. (SVER(F) 68107).

SPARASSIS CRISPA Wulfen: Fr.

**Lit.:** Lepik (1936); Padernik (1942); Parmasto (1970); Red Data Book (1999); Kalamees & Liiv (2005).

**Pär:** Raeküla, in a pine forest, on roots, 27 Sep 1990 *I.L.* (TAA 144854). **Põl:** Valgemetsa, in a pine forest, on soil, 6 Sep 1995 *M.V.* (TAA 162299).

**Tar:** Kolkja, luxuriant forest of *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on roots of spruce, 12 Aug 2006 A.S. (SVER(F)

68109). **Võr:** Antsla Comm., Ähijarve, on roots of *Pinus sylvestris* in a pine forest of *Oxalis* site type, 11 Oct 2002 *E.P.* (TAA 185669); Võru Comm., Võlsi, 30 Aug 2005 *E.P.* (TAA 183262).

\*TYPHULA CAPITATA (Pat.) Berthier

**I-Vir:** Vaivara Comm., Arumäe, on dead stems of *Juncus* sp., 15 Aug 2006 A.S. (SVER(F) 68087).

**Tar:** Kolkja, mixed forest of *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on dead stems of *Calamagrostis*, 12 Aug 2006 A.S. (SVER(F) 67807);

\*TYPHULA CARICINA P. Karst.

**Tar:** Kolkja, mixed forest of *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on dead stems of *Carex* sp., 12 Aug 2006 A.S. (SVER(F) 67942); Elva Comm., Uderna, at Elva river, on dead stems of *Carex* sp. (last year fruit-bodies), 1 May 2008 A.S. (SVER(F) 68108).

\*TYPHULA CRASSIPES Fückel.

**Syn.:** *T. corallina* Quel. & Pat., *T. cylindracea* P. Karst.

**I-Vir:** Vaivara Comm., Tuulukse, mixed forest of spruce, pine, birch and aspen, on dead stems of *Veronica* sp., 15 Aug 2006 A.S. (SVER(F) 67934).

**Rap:** Kuusiku, mixed herb-rich forest of spruce, pine and oak on calcareous soils, on rotten leaves of *Acer platanoides*, 23 Sep 2005 A.S. (SVER(F) 67833).

TYPHULA CULMIGENA (Mont. & Fr.) Berthier

**Lit.:** Parmasto (1963a, 1965).

**Hii:** Kõrgessaare, alvar forest of spruce and juniper, on a dead stem of *Inula* sp., 25 Oct 2007 A.S. (SVER(F) 68014). **Tar:** Kolkja, mixed forest of *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on dead stems of *Calamagrostis*, 12 Aug 2006 A.S. (SVER(F) 67912).

TYPHULA ERYTHROPUS (Pers.: Fr.) Fr.

**Lit.:** Parmasto (1963a, 1965); Kalamees (1966a); Parmasto & Parmasto (2005).

**I-Vir:** Avinurme Comm., Änniksaare, on decaying leaves of *Alnus incana*, 30 Sep 1958 *E.P.* (TAA 9665). **Jõg:** Puurmani Comm., Rebase, on decaying leaves of *Betula pubescens*, 1 Oct 1958 *E.P.* (TAA 6660). **L-Vir:** Laekvere Comm., Sakssaare, on decaying leaves of aspen, 2 Oct 1958 *E.P.* (TAA 5776). **Tar:** Kolkja, mixed forest of *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on fallen leaves of *Alnus glutiniosa*, 12 Aug 2006 A.S. (SVER(F) 67816).

The most common *Typhula* species in Estonia.

TYPHULA GRAMINUM P. Karst.

**Lit.:** Käsebier et al. (1926).

**I-Vir:** Valaste, mixed luxuriant forest, on dead leaves of *Deschampsia*, 14 Aug 2006 A.S. (SVER(F) 67842). **Tar:** Kolkja, mixed forest of *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on dead leaves and stems of *Phleum*, 12 Aug 2006 A.S. (SVER(F) 67997).

\*TYPHULA HYALINA (Quél.) Berthier

**Rap:** Kuusiku, mixed herb-rich forest of spruce, pine and oak on calcareous soils, on rotted stems and leaves of *Melica*, 23 Sep 2005 A.S. (SVER(F) 67851); **Tar:** Elva, on a grass, 10 Aug 1964 A.R. (TAA 43273); Kolkja, mixed forest of *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on dead leaves of *Scirpus*, 12 Aug 2006 A.S. (SVER(F) 67921).

TYPHULA INCARNATA Lasch ex Fr.

**Lit.:** Kask (1963, 1965, 1966); Snow mold... (1963); Parmasto (1965, 1970); Pöldmaa (1967); Marland (1968); Kask (1963).

**I-Vir:** Valaste, mixed herb-rich forest, on dead and live leaves of *Agrostis* sp., 14 Aug 2006 A.S. (SVER(F) 68106).

\*TYPHULA ISHIKARIENSIS Imai

**Tar:** Tartu, a park at Riia street, on grasses (*Phleum* sp. and other grasses), 30 Apr 2008 A.S. (SVER(F) 68002).

\*TYPHULA LUTESCENS Boud.

**Hii:** Kõrgessaare, alvar habitat with spruce and juniper, on dead stems of *Epilobium* sp., 25 Oct 2007 A.S. (SVER(F) 67930). **Tar:** Kabina, on rotten roots of *Carex* sp., 11 Oct 1968 K.K. (TAA 77622); Kolkja, mixed forest of *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on dead stems of *Equisetum* sp., 12 Aug 2006 A.S. (SVER(F) 67811).

TYPHULA MICANS (Pers.: Fr.) Berthier

**Syn.:** *T. anceps* P. Karst.

**Lit.:** Dietrich (1856), Witkowski (1934), Parmasto (1965).

**Saa:** Kuressaare, alvar habitat with *Quercus*, *Rosa*, *Cotoneaster* and *Artemisia*, on dead stems of *Humulus lupulus*, 10 Aug 2006 A.S. (SVER(F) 67963). **Tar:** Nõo Comm., Mosina, by the Elva River, on a dead stem of *Urtica dioica*, 29 Sep 1998 K.L. (TAA 165455).

\*TYPHULA OLIVASCENS Berthier

**Hii:** Kõrgessaare, alvar forest with spruce and juniper, on rotten petioles of *Athyrium*, 25 Oct 2007 A.S. (SVER(F) 67961). **I-Vir:** Valaste, mixed luxu-

riant forest, on rotten petioles of *Athyrium*, 14 Aug 2006 A.S. (SVER(F) 67820). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on dead petioles of a fern, 12 Aug 2006 A.S. (SVER(F) 67871).

TYPHULA PHACORRHIZA (Reichard: Fr.) Fr.

**Lit.:** Parmasto (1961, 1963a, 1965).

**Jõg:** Puurmani Comm., Rebase, *Piceetum oxalidosum*, on decaying leaves of *Betula pubescens*, 1 Oct 1957 E.P. (TAA 7562). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on fallen leaves of birch and alder, 12 Aug 2006 A.S. (SVER(F) 67989). **Võr:** Võru-Kubja, on decaying *Phragmites communis*, 13 Oct 1976 B.K. (TAA 69347).

TYPHULA QUISQUILIARIS (Fr.) Henn.

**Lit.:** Parmasto (1959, 1963a, 1965); Kalamees (1966a).

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak on calcareous soil, on dead petioles of *Pteridium aquilinum*, 23 Sep 2005 A.S. (SVER(F) 68006). **Saa:** Viidumäe Nature Reserve, on decaying petioles of *Pteridium aquilinum*, 13 Sep 1993 E.P. (TAA 152714).

TYPHULA SCLEROTIODES (Pers.) Fr.

**Lit.:** Parmasto (1963a, 1965).

**I-Vir:** Valaste, mixed forest, on a dead stem of *Aconitum*, 14 Aug 2006 A.S. (SVER(F) 67898).

**Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp., *Sorbus aucuparia* and *Salix* spp., on a rotten stem of *Angelica*, 12 Aug 2006 A.S. (SVER(F) 67958).

TYPHULA SETIPES (Grev.) Berthier

**Syn.:** *Clavaria diaphana* Schumach., *C. ovata* Pers., *Pistillaria acuminata* Fuckel, *Typhula gyrans* Fr., *T. pussila* Fr. **Lit.:** Dietrich (1856); Parmasto (1963a, 1965).

**I-Vir:** Valaste, mixed forest, on fallen birch leaves, 14 Aug 2006 A.S. (SVER(F) 67823). **Pär:** Kurgja, on decaying leaves of *Alnus*, 8 Oct 1976 coll. B.K., det. A.S. (TAA 69295). **Tar:** Tõravere, on decaying leaves of *Malus domestica*, 12 Oct 1967 coll. P.P., det. A.S. (TAA); on decaying birch leaves, 28 Oct 1982 coll. B.K., det. A.S. (TAA 115591).

One of the most common *Typhula* species in Estonia.

TYPHULA SPATHULATA (Peck) Berthier

**Syn.:** *T. erumpens* Corner. **Lit.:** Saar et al. (2007).

**Hii:** Kõrgessaare, alvar forest with spruce and juniper, on a dead twig of *Rosa* sp., 25 Oct 2007

A.S. (SVER(F) 68021). **I-Vir:** Illuka Comm., Poruni Nature Reserve, on a fallen rotted twig of *Salix*, 23 Oct 2006 *E.P.* (TAA 189585); Valaste, mixed luxuriant forest, on fallen twigs of willow, 14 Aug 2006 A.S. (SVER(F) 67980).

\**TYPHULA SPHAEROIDEA* Remsberg

**Rap:** Kuusiku, mixed herb-rich forest with spruce, pine and oak on calcareous soils, on fallen dead oak twigs, 23 Sep 2005 A.S. (SVER(F) 68059).

\**TYPHULA STRUPHIPTERIDIS* Corner

**I-Vir:** Illuka Comm., Boroni Nature Reserve, in a nemoral forest, on dead petioles of *Matteucia struthiopteris*, 3 Oct 1967 *E.P.* (TAA 18967); Valaste, moisture forest with *Alnus*, *Betula*, *Salix* and *Padus*, on dead petioles of *Matteuccia*, 14 Aug 2006 A.S. (SVER(F) 67892). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp., *Sorbus aucuparia* and *Salix* spp., on rotten petioles of *Matteuccia* in a moisture microhabitat, 12 Aug 2006 A.S. (SVER(F) 67974).

\**TYPHULA SUBVARIABILIS* Berthier

**Hii:** Kõrgessaare, alvar forest with spruce and juniper, on fallen dead leaves of *Frangula*, 25 Oct 2007 A.S. (SVER(F) 68102). **Rap:** Kuusiku, mixed herb-rich forest with spruce, pine, oak and elms on calcareous soils, on fallen rotten leaves of *Sorbus*, 23 Sep 2005 A.S. (SVER(F) 67984).

\**TYPHULA TODEI* Fr.: Fr.

**Syn.:** *T. athyrü* Remsberg

**Pär:** Orajõe, on *Athyrium filix-femina*, 15 Sep 1957 *E.P.* (TAA 8324). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp., *Sorbus aucuparia* and *Salix* spp., on dead petioles of *Athyrium*, 12 Aug 2006 A.S. (SVER(F) 67966); Elva Comm., Uderna, moisture habitat, on *Athyrium*, 1 May 2008 A.S. (SVER(F) 67993).

*TYPHULA TRIFOLII* Rostrup

**Lit.:** Juhans (1934); Kivi (1962); Kask (1966); Põldmaa (1967); Parmasto (1963a); Kivi & Kivi (1968).

**Hii:** Kõrgessaare, alvar meadow, parasitic on *Lupinus*, 25 Aug 2007 A.S. (SVER(F) 68017). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and on base of a live *Lupinus*, 12 Aug 2006 A.S. (SVER(F) 67876).

*TYPHULA UNCIALIS* (Grev.) Berthier

**Syn.:** *Clavaria typhuloides* Peck. **Lit.:** Parmasto (1963a, 1965); Eesti... (1969); Corner (1970).

**I-Vir:** Valaste, moisture habitat with *Alnus* and *Salix*, on dead petioles of *Petasites*, 14 Aug 2006

A.S. (SVER(F) 68053). **Pär:** Massiaru, on decaying *Chamaenerion angustifolium*, 13 Aug 1963 coll. *P.P.*, det. A.S. (TAA 30349). **Saa:** Pihlta Comm., Kangrusselja, on dead stems of *Angelica sylvestris* in a mixed forest of *Picea* and *Populus*, 29 Sep 1998 *E.P.* (TAA 174052). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on dead petioles of *Angelica*, 12 Aug 2006 A.S. (SVER(F) 67970).

*TYPHULA VARIABILIS* Riess

**Lit.:** Parmasto (1965).

**I-Vir:** Valaste, mixed luxuriant forest, on dead stems of *Angelica*, 14 Aug 2006 A.S. (SVER(F) 67905); Vaivara Comm., Arumäe, on *Anthriscus*, 15 Aug 2006 A.S. (SVER(F) 67948). **Tar:** Kolkja, mixed forest with *Picea abies*, *Populus tremula*, *Betula* spp. and *Sorbus aucuparia*, on dead stems of *Urtica*, 12 Aug 2006 A.S. (SVER(F) 67890).

## DISCUSSION

The number of species reported from Estonia (103) is a little bit smaller if compared with, e.g., Finnish clavarioid biota (115 species – Kotiranta et al., 2009). However, the history of investigation of clavarioid fungi is quite similar in these countries, but the area of Estonia (45,227 sq km) is much smaller than of Finland (337,000 sq km), thus covering narrower spectrum of habitats and biogeographical zones. The number of species is smaller in Lithuania (86 – Shiryayev & Irsenaite, 2009), and in the adjacent Russian region (Leningrad District) (91 species – Shiryayev, unpubl.) which have similar size of territory. After long-term studies of clavarioid fungi's biota in the hemiboreal zone of the Ural Mountain region (Russia), 120 species have been found on an area of similar size (Shiryayev, 2006, 2007). A list of the whole hemiboreal zone of eastern Baltic (south-western Finland, Estonia, Latvia and northern Lithuania) includes 115 species – but about 200 specimens are still unidentified. Possibly the Eastern Baltic hemiboreal zone harbors about 130 species of clavarioid fungi.

Forty six species are new for the country and most of them have been found both north and south of Estonia. Possibly, four species have the northern border of distribution in Estonia (*Ceratellopsis sagittaeformis*, *Clavaria amoenoides*, *Ramaria broomei*, *R. sanguinea*), and two species have their southern points of distribution here (*Multiclavula corynoides*, *Typhula*

*caricina*) except special habitats in European mountains (the Carpathians, Balkans, Alps and Caucasus).

Information on distribution of four species in Estonia (*Clavaria straminea*, *Multiclavula delicata*, *Ramaria conjunctipes* and *Ramaria pusilla*) mentioned in literature, could not be confirmed neither by observations nor by herbarium specimens.

The largest genera *Ramaria* (27 species), *Typhula* (23), *Clavaria* (11), *Clavulinopsis* (7), and *Ramariopsis* (7) include about 75% of species of the total list. The species of the genus *Ramaria* are distributed mainly in the hemiboreal zone of Europe, but were also found in all nature zones of Northern Eurasia in the Ural Mountains from Arctic regions (Polar Urals, Novaya Zemlya islands and Yamal peninsula) to semideserts of the Western Kazakhstan (Shiryaev, 2006). According to that study, the genus *Ramaria* has the highest species richness in nemoral and hemiboreal areas (in the optimal conditions for broad-leaved trees), becomes more poor in boreal and steppe ecosystems. The number of species is lowest in arctic, alpine and desert biocoenoses, where genus *Typhula* is most common. In general, the biota of Estonian clavarioid fungi may be characterized as a boreo-nemoral with domination of “southern”, i.e. nemoral species.

The most common species found are *Typhula erythropus* (47 observations / 4.8%), *Macrotyphula juncea* (41 / 4.1%), *Typhula setipes* (40 / 4.0%), *Clavulina cinerea* (38 / 3.8%), *Clavariadelphus ligula* (37 / 3.7%), *Ramaria gracilis* (37 / 3.7%) and *Typhula phacorrhiza* (36 / 3.6%). These few species constitute about 28% of all observations. All these species have very wide ecological amplitude. Some are common in human influenced sites, some are very common on newly fallen leaves and needles or on soil in old-growth forests. *Typhula erythropus* has been found in old-growth forests on newly fallen aspen leaves, more rarely on maple and elm. It is also frequent on birch leaves in open habitats like parks, wetlands and bogs. *Clavulina cinerea*, *Ramaria stricta*, *Typhula culmigena* and *T. setipes* are equally common in natural and anthropogenic habitats. Rare or extremely rare in European hemiboreal old-growth conifer-broad-

leaved forests are *Clavaria rosea*, *Clavulinopsis rufipes*, *Clavulinopsis umbrinella*, *Clavulina amethystina*, *Lentaria subcaulescens*, *Multiclavula mucida*, *M. vernalis*, *Pterula subulata*, *Ramaria botrytis*, *R. obtusissima*, *R. rubella* and *Sparassis crispa*, in old luxuriant broad-leaved forests – *Clavaria amoenoides*, *Clavaria zollingeri*, *Ramaria botrytoides*, *R. fennica* and *Ramariopsis crocea*.

Several species very rare in Estonia have been found in threatened alvar communities on calcareous soils (*Ramaria broomei*, *Ramariopsis pulchella*) or in *Sphagnum* bogs (*Multiclavula corynoides* and *Clavaria argillacea* var. *sphagnicola*), possibly, both last mentioned taxa are Pleistocen relics survived after glacial times.

*Clavariadelphus sachalinensis* is possibly in its south-western border of distribution in Estonia. It is a common species in boreal forests of northern regions of European Russia, but becomes more seldom in Central Finland, and practically absent in southern Finland. We know only seven localities of this fungus in hemiboreal Baltic region, including five records from Finland (Åland Islands and Varsinais-Suomi – see Kotiranta et al., 2009), one from Estonia (see above) and one from northern Lithuania (Shiryaev & Irsenaite, 2009). All in all, this species has not been mentioned from the temperate zone of Europe, and southernmost records of it are in the mountainous conifer forests of the Carpathians (two localities), the species is absent in the Alps (Jülich, 1984). In the Ural region *C. sachalinensis* is a common species in middle boreal forests, widespread (more rare) in southern taiga, but only two localities are known on northern mountain slopes in hemiboreal forests, and it is absent in steppe zone (Shiryaev, 2004, 2006, 2007).

Most of the species recorded are saprotrophs, which grew on soil, dead wood and leaf or grass litter. The soil-inhabiting group is the largest with its 49 species, which are mostly rare or uncommon (1–10 collections), except the widespread *Clavaria argillacea*, *Clavulina cinerea*, *C. cristata*. 38 species are inhabiting forest litter, including 27 obligate ones (*Macrotyphula juncea*, *Typhula culmigena*, *Clavariadelphus ligula* and *Pterula gracilis*) and 11 facultative species. The most common with highest frequencies are leaf litter species (*Typhula erythropus*, *T. setipes*).

The number of wood-decaying species is rather low: only 13 species including 9 obligate ones (e.g., *Clavicornia pyxidata* and *Lentaria byssiseda*); in general, the species of this ecological group are rare or uncommon, except *Ramaria stricta*. That species has been recorded on fallen trunks, branches, on buried woody substrates, as well as on naked soil intermixed with needles and leaves.

The most common pathogen on herbs is *Typhula incarnata*, mentioned in several publications; very rare pathogens are *Sparassis crispa*, *Typhula ishkariensis* and *T. trifolii*.

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